09/194631

PC 8706

398 Rec'd PCT/PTO 30 NOV 1998

Pneumatic Brake Force Booster

The present invention relates to a pneumatic brake force booster for automotive vehicles which includes a booster housing whose interior is subdivided by a movable wall into a first chamber (vacuum chamber) and a second chamber (working chamber), and a control housing accommodating a control valve which controls a pneumatic pressure differential that acts upon the movable wall, the said control valve having at least two sealing seats which cooperate with an elastic valve member, one of the sealing seats being operable by an actuating rod, on the one hand, and by an electromagnet independently of the actuating rod, on the other hand, wherein a cable duct is hermetically sealed in the booster housing through which electric lines extend into the interior of the booster housing.

A brake force booster of this type is, for example, known from international patent application WO 95/32879. In the prior art brake force booster, the cable duct comprises two hermetically sealed parts. The first, preferably tubular part which projects into the interior of the booster housing is configured as a measuring element of a travel sensor which is used to sense the movement of the movable wall of the brake force booster. The second part which is especially used to position and seal the electric lines is shifted into a large-diameter accommodation provided at the end of the first part. The first part is accommodated in the wall of the booster housing so as to be hermetically sealed by a sealing sleeve, and the sealing sleeve is attached to an opening in the booster housing.

The prior art brake force booster suffers from the special

disadvantage of the two-part design of the cable duct which necessitates high costs in manufacture. Further shortcomings are the expenditure in time needed in the manufacture and the relatively reduced safety of the manufacturing process.

Therefore, an object of the present invention is to suggest provisions which permit a major reduction in costs related to the manufacture of the cable ducts. An additional objective is to ensure a simple assembly and a great reliability in operation of the overall assembly.

According to the present invention, this object is achieved in that the cable duct is configured as an injection molded plastic part wherein inside the electric lines are partly insulated.

A preferred aspect of the object of the present invention includes that the electric lines are tin-plated in their insulated portion. Aspiration of air through the spaces between the strands into the vacuum chamber is prevented by this measure.

To reliably prevent contact of the insulated portion in the manufacture of the cable duct of the present invention, according to another preferred aspect of the object of the present invention, the electric lines are fitted to a retaining member which has a star-like configuration in cross-section, and the cable duct is provided by plastic lamination of the retaining member with the lines.

To achieve an accurately defined guiding of the electric lines in the inside of the brake force booster housing, the cable duct has a radial extension which bears against the booster housing and on which a retaining clip is provided to position the electric lines.

The present invention will be explained in detail in the following description by way of an embodiment making reference to the accompanying drawing.

In the drawing,

Figure 1 is a partial longitudinal cross-sectional view of the brake force booster of the present invention.

Figure 2 is a partial axial sectional view of the cable duct provided in the brake force booster of Figure 1.

A booster housing 1 (only represented in Figure 1) of the illustrated vacuum brake force booster of the present invention is subdivided by an axially movable wall 2 into a working chamber 3 and a vacuum chamber 4. The axially movable wall 2 includes a circular, force-transmitting deepdrawn sheet-metal diaphragm plate 5 and a flexible diaphragm 6 which abuts thereon and is made of a rubber-like material. Diaphragm 6, in the capacity of a rolling diaphragm, provides a sealing between the outside periphery of the diaphragm plate 5 and the booster housing 1. In the middle of the diaphragm plate 5 and the diaphragm 6, the two parts are connected to a control housing (not shown) which accommodates a control valve (not shown either).

A cable duct, designated by reference numeral 7, is unrotatably accommodated in an opening 8 in the booster housing half shown on the the left side in the drawing, and is retained by a bayonet ring 10. Radially inwardly directed projections 11 of ring 10 cooperate, or form a bayonet-type connection, with grooves 12 provided in the cable duct 7. A ring seal 13 reliably seals the cable duct 7 in relation to the booster housing 1. Ring seal 13 is axially press fitted between the surface of

booster housing 1 and the end surface of bayonet ring 10 facing the booster housing 1 during assembly of the cable duct 7 of the present invention. A second ring seal 14 which is arranged in a radial groove 15 in the cable duct 7 is used to seal the cable duct 7 in relation to the bayonet ring 10.

As can be seen from Figure 2 in particular, the above-mentioned cable duct 7 has a substantially cylindrical shape and includes a portion 16 which extends from the inside through the booster housing 1 in the area of the opening 8. Portion 16 passes over into a radial extension 17 of larger diameter which, in the assembled condition of the cable duct, abuts inside the vacuum chamber 4 on the booster housing 1. The anti-torsion mechanism in opening 8 is provided by a projection (not shown) which axially protrudes from the extension 17 and is received in a recess provided at the edge of opening 8. Further, a retaining clip 24 is shaped on the frontal end of extension 17. Clip 24 is used to position the cable portion 25 that extends into the interior of the booster housing 1.

It can be seen from the mid-portion (preferably shown in a partial view) of the cable duct 7 illustrated in Figure 2 that a plurality of lines 18, 19, integrated in an electric cable loom 20, extend without interruption through the cable duct 7 and are stripped in their portion 21, 22 disposed in duct 7. It is especially appropriate that the lines 18, 19 are tin-plated in the stripped portion 21, 22, so that aspiration of air through the spaces between the strands is rendered impossible.

In making the cable duct 7 of the present invention, a plurality of lines (for example, five lines) are fitted to a retaining member 23 (shown in dotted lines in the drawing) which has a preferably star-like configuration in cross-section. Subsequently, plastic material is spray-coated onto the so

prepared arrangement in a suitable extrusion die. The above-mentioned star-like profile prevents compression of the stripped points as a result of the die-casting pressure.

During the assembly of the cable duct 7 of the present invention, initially, its portion 16 which extends outwardly from the booster housing 1 is slipped from the inside through the opening 8 and is positioned so that the projection (not shown), used as an anti-torsion mechanism, engages the recess in the booster housing 1, and the cable duct 7 with its radial extension 17 will move into abutment on the booster housing 1. Thereafter, the above-mentioned ring seal 12 is fitted around the cable duct 7, whereupon the bayonet ring 10 is so slipped on that the initially described projections 11 are inserted into the grooves 12 in the cable duct 7. Because one (27) of the groove flanks 26, 27 passes into an inclination 28, clockwise rotation of the bayonet ring 10, in the course of which the projections 11 are moved along the inclinations 28, cause tightening of the bayonet connection and a simultaneous press fit of the ring seal 13. The result is a proper sealing of the cable duct of the present invention in relation to the booster housing 1. At the end of the described rotation, the projections 11 abut on a stop 30 which is provided by a radial rib 29, respectively, which bounds the grooves 12.

List of Reference Numerals:

1 booster housing
2 movable wall
3 working chamber
4 vacuum chamber
5 diaphragm plate
6 rolling diaphragm
7 cable duct
8 opening

10 bayonet ring
11 projection
12 groove
13 ring seal
14 ring seal
15 annular groove
16 portion
17 extension
18 line
19 line
20 cable
21 portion
22 portion
23 retaining member
24 retaining clip
25 cable portion
26 groove flank
27 groove flank
28 inclination
29 rib
30 stop